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DVD BONDING APPARATUS
[DVD hariawase souchi]

Nobukazu Hosogai

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INVENTOR	(72):	Nobukazu Hosogai
APPLICANT	(71):	391005156 Senshin K.K.
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Claims

1. An apparatus in which a plurality of rotary shafts is disposed on a rotary table that intermittently rotates in an indexed fashion through at least a feed position, adhesive application position, stacking position, and substrate rotation position; a holding member is disposed at the top end of each of said rotary shafts; one substrate, the lower of the two substrates that comprise a DVD, made from synthetic resin, is fed onto each holding member at said feed position, an adhesive is applied to the planar surface of said one substrate while it is rotated at the adhesive application position, the other, upper substrate, is stacked on the one substrate with the adhesive therebetween at the stacking position, and said two stacked substrates are rotated at the substrate rotation position to spread the adhesive and bond the two substrates, wherein said DVD bonding apparatus is characterized by being configured with a rotary body disposed on each of the aforementioned rotary shafts, and substrate rotation mechanisms that rotate said rotating bodies disposed at the aforementioned adhesive application position and substrate rotation position as positions outside the aforementioned rotary table.

2. The DVD bonding apparatus disclosed in Claim 1, which is characterized by the aforementioned substrate rotation mechanism being comprised of a moving stand that enables advancing/retreating operations toward the aforementioned rotary body, an advancing/retreating mechanism that actuates advancing/retreating of said moving stand, and a drive mechanism that comprises a drive belt that enables contact with and separation from said rotary body by the advancing/retreating operation of the moving stand.

3. The DVD bonding apparatus disclosed in Claim 1 or 2, which is characterized in that the aforementioned drive belt is comprised of an endless belt, said drive belt is disposed threaded through a drive pulley and a pair of guide pulleys, a spring member is disposed that moves one of said guide pulleys

in the direction separating it from the other guide pulley, and advancing the aforementioned moving stand causes the drive belt to come in contact in a curved state along the circumferal surface of the rotary body.

4. The DVD bonding apparatus disclosed in Claim 1, 2, or 3, which is characterized by the aforementioned drive belt being a toothed belt.

Detailed explanation of the invention

[0001]

Technical field of the invention

The present invention pertains to a DVD bonding apparatus that is used in the processing of manufacturing DVDs (digital video disks) as optical disks.

[0002]

Prior art

This type of DVD is generally divided into read-only DVD-ROM and rewriteable DVD-RAN. Of these, there are three types of SD standard DVD disks, comprising, e.g., SD-5 (one-sided disk), SD-9 (one-sided read-only, two-layer disk), and SD-10 (two-sided disk) in the SD standard, read-only SD-ROM, which are constructed by, e.g., using an adhesive or adhesive sheet to bond two 12 cm-diameter × 0.6 mm-thick disk-shaped substrates, made from synthetic resin with a refractive index on the level of polycarbonate. Of these, the SD-9 in particular requires that the adhesive layer be transparent to play back wavelength light and has a uniform adhesive layer thickness so that the two layers of signal can be read from one side.

[0003]

These two-layered optical disks generally are manufactured by, first, a raw disk production step in which the raw disk is product, and then a stamp production step in which a metal plate is produced to transfer the signal surface, a duplication step in which the substrates are mass-produced using this stamp, and finally a bonding step in which two substrates are bonded together.

[0004]

In the bonding step, here, first, a first substrate W_1 of two DVD substrates W_1, W_2 is vacuum adhered and affixed to a rotating disk-shaped holding member 1, as shown in Figure 7, an adhesive S made from ultraviolet-cured resin is dripped onto the substrate W_1 while rotating the holding member 1 at low speed, whereby the adhesive S is applied from an adhesive application mechanism in a ring pattern on the top of the substrate W_1, as shown in Figure 8, and then, as shown in Figure 9, the other substrate W_2 is stacked by a stacking mechanisms omitted from the figure, onto the first substrate W_1 and the holding member 1 is rotated at high speed, whereby the adhesive S is spread by centrifugal force between the mutually facing substrates W_1, W_2 and excess adhesive S is forced out from the outer edge of the substrates W_1, W_2, after which the adhesive S is cured by using an ultraviolet irradiation mechanism to irradiate ultraviolet light R from above the substrate W_1, as shown in Figure 10, bonding together the two substrates W_1, W_2.

[0005]

Thus, with the automation of bonding, the bonding step has come to be accomplished sequentially at various operating stations, wherein a rotary table is utilized that intermittently rotates in an indexed fashion through at least a feed position, adhesive application position, stacking position, and substrate

rotation position, a plurality of rotary shafts is disposed on this rotary table, and a holding member, on which the substrates can be mounted and held, is disposed at the top end of each rotary shaft.

[0006]

Problems to be solved by the invention

However, in the conventional configuration above, rotation of the aforementioned rotary shafts is accomplished by rotation mechanisms attendant to each of the plurality of rotary shafts, and are disposed at each rotary shaft, and because this plurality of rotary shafts is disposed on the rotary table, the rotation mechanisms are also disposed on the rotary table side, and thus the various rotation mechanisms and the rotary table rotate together, which increases the inertial moment of the rotary table and invites decreased indexed positioning accuracy, resulting in problems of the commensurate occurrence of bonding defects, as well as the increased size and excessively high production costs for the apparatus.

[0007]

Means to solve the problems

The purpose of the present invention is to solve such problems, and disclosed are, in Claim 1 of the invention, an apparatus in which a plurality of rotary shafts is disposed on a rotary table that intermittently rotates in an indexed fashion through at least a feed position, adhesive application position, stacking position, and substrate rotation position; a holding member is disposed at the top end of each of said rotary shafts; one substrate, the lower of the two substrates that comprise a DVD, made from synthetic resin, is fed onto each holding member at said feed position, an adhesive is applied to the planar surface of said one substrate while it is rotated at the adhesive application position, the other, upper substrate, is stacked on the one substrate with the adhesive therebetween at the stacking position, and said two stacked substrates

are rotated at the substrate rotation position to spread the adhesive and bond the two substrates, wherein said DVD bonding apparatus is characterized by being configured with a rotary body disposed on each of the aforementioned rotary shafts, and substrate rotation mechanisms that rotate said rotating bodies disposed at the aforementioned adhesive application position and substrate rotation position as positions outside the aforementioned rotary table.

[0008]

In addition, Claim 2 discloses an invention that is characterized by the aforementioned substrate rotation mechanism being comprised of a moving stand that enables advancing/retreating operations toward the aforementioned rotary body, an advancing/retreating mechanism that actuates advancing/retreating of said moving stand, and a drive mechanism that comprises a drive belt that enables contact with and separation from said rotary body by the advancing/retreating operation of moving stand, Claim 3 discloses an invention that is characterized in that the aforementioned drive belt is comprised of an endless belt, said drive belt is disposed threaded through a drive pulley and a pair of guide pulleys, a spring member is disposed that moves one of said guide pulleys in the direction separating it from the other guide pulley, and advancing the aforementioned moving stand causes the drive belt to come in contact in a curved state along the circumferal surface of the rotary body, and Claim 4 discloses an invention that is characterized by the aforementioned drive belt being a toothed belt.

[0009]

Conditions of embodiment of the invention

Figures 1 through 6 show embodiments of the present invention, wherein components that are the same as in the aforementioned conventional configuration have been described with the same keys, and wherein

T is a rotary table, which in this case is installed on a machinery stand M, and intermittently moves in an indexed fashion to a total of ten stations, comprising a feed position a, static elimination position b, adhesive application position c, stacking position d, micro-pressure position e, substrate rotation position f, ultraviolet irradiation position g, air position h, pass/fail inspection and removal position i, and cleaning position j, and therefore, ten rotary shafts 2 are vertically disposed on the rotary table T by means of respective freely rotating bearing cylinders 3, a rotating disk-shaped holding member 1 is mounted on the upper end of each rotary shaft 2, a positioning center shaft 1a, which can fit into the circular fitting hole W_3 formed at the center of each of the two upper and lower substrates W_1, W_2, is formed protruding in the center area of holding member 1, and vacuum grooves, which are connected to a vacuum pressure source outside the figure, are formed in the planar surface of the holding member 1, and are formed so that one of the substrates W_1 can be vacuum-held and released in a positioned state by this center shaft 1a.

[0010]

4 is a substrate rotation mechanism, which, in this case, is disposed at each of the adhesive application positions c, substrate rotation position f, and ultraviolet irradiation position g, and which is constituted from a rotary body 5 that is mounted to the bottom of each of the aforementioned rotary shafts 2, a moving stand 6 that can advance and retreat in the direction of the rotary body 5, an advancing/retreating mechanism 7 that actuates advance and retreat of the moving stand 6, and a drive mechanism 9 that includes a drive belt that can be contacted with and retracted from the rotary body 5 by the advancing/retreating of the moving stand 6.

[0011]

In this case, a mounting stand 10 is mounted to the machinery stand M, the moving stand 6 is mounted by means of a bearing 11 on the mounting stand 10 so that it can advance and retreat, an advancing/retreating cylinder 12 is disposed horizontally on the mounting stand 10, the rod of the advancing/retreating cylinder 12 is coupled with the moving stand 6, a bracket 13 is mounted to the moving stand 6, a drive motor 14 is vertically mounted on the bracket 13, a drive shaft 15 is vertically mounted by means of a bearing 16 on the moving stand 6, the main shaft of the drive motor 14 is coupled with the drive shaft 15, a drive pulley 17 is mounted on the drive shaft 15, a mounting plate 18 is mounted on one side of the moving stand 6, a pivot shaft 19 is mounted to the mounting plate 18, a guide pulley 20 is mounted to the drive shaft 15, and a slide plate 22 is disposed by means of a bearing 21 on the other side of the moving stand 6 so that it can freely move in the direction approaching the guide pulley 20, a spring-mounting plate 23 is assembled on the moving stand 6, a stopper 24 is disposed on the spring-mounting plate 23, a spring member 25 is supported between the slide plate 22 and the spring-mounting plate 23, a guide pulley 27 is mounted on a pivot shaft 26, an endless drive belt 8 is threaded around the drive pulley 17 and the pair of guide pulleys 20, 27, and configured so that advancing the aforementioned moving stand 6 causes the drive belt 8 to come in contact in a curved state along the circumferal surface of the rotary body 5.

[0012]

Thus, the drive belt 8 is threaded so that it can run circulating around three pulleys, consisting of the drive pulley 17 and guide pulleys 20, 27, and is tensioned by the spring member 25, as shown in Figure 2, and the drive belt 8 is circulated by driving it with the drive motor 14, and when the advancing/retreating mechanism 7 then advances the moving stand 6, the drive belt 8 contacts the circumferal surface of the

rotary body 5, as shown in Figure 3, and by further advancing, the slide plate 22 moves toward the guide pulley 20, resisting against the spring member 25, which causes the drive belt 8 to flex so that it wraps along the circumferal surface of the rotary body 5, while when the moving stand 6 is caused to retreat by the advancing/retreating mechanism [7], and the guide pulley 27 is moved back to its original position by the spring member 25, as shown in Figure 2.

[0013]

In addition, in this case, the aforementioned drive belt is a toothed belt, a so-called timing belt, and the drive pulley 17 and guide pulleys 20, 27 are formed into toothed pulleys.

[0014]

Because this embodiment is configured as above, in the bonding process, first, at the feed position a, just one of the substrates W_1 of the two DVD substrates W_1, W_2 is supplied by a substrate feed mechanism, which is not shown, which substrate W_1 is held affixed by vacuum suction action onto the holding member 1, and then static electricity is eliminated at the static elimination position b, after which, at the adhesive application position c, an adhesive S made from ultraviolet-cured resin is dripped onto the substrate W_1 while rotating the holding member 1 at low speed with the substrate rotation mechanism 4, whereby the viscous adhesive S is applied in a ring pattern on the top of the substrate W_1, and then, at the stacking position d, the other substrate W_2 is concentrically stacked onto the first substrate W_1 in a form as though it was stacked on itself from above, after which, at the micro-pressure position the other substrate W_2 is lightly pressed under weak pressure onto the first substrate W_1, slightly spreading the adhesive S, after which, at the substrate rotation position f, the holding member 1 is rotated at high speed by the substrate rotation mechanism 4, whereby the adhesive S is thoroughly spread between the mutually facing

substrates W_1, W_2 and excess adhesive S is forced out from the outer edge of the substrates W_1, W_2, and in this case, an annular reservoir groove W_4 is formed in the planar surfaces of the substrates W_1, W_2, and excess adhesive S also drops into this reservoir groove W_4, after which, at the ultraviolet irradiation position g, the adhesive S is cured by irradiating it with ultraviolet rays from an ultraviolet lamp while rotating the holding member 1 at low speed with the substrate rotation mechanism 4, and then at the pass/fail inspection and removal position i, the acceptability of the stacked condition is inspected and the product is removed, after which, contamination, such as adhesive, etc., on the holding member is cleaned at the cleaning position j, and a continuous series of stacking steps is constituted by repeating this process.

[0015]

In this case, because of a configuration in which a rotary body 5 is disposed on each of the aforementioned rotary shafts 2, and a substrate rotation mechanism 4, which rotates the rotary body 5, is disposed at positions outside the rotary table T at the aforementioned adhesive application position c, substrate rotation position f, and ultraviolet irradiation position g, increases in inertial moment of the rotary table T can be minimized since the substrate rotation mechanisms 4 that rotate the rotary shafts 2 are not disposed on the rotary table T, whereby a good bonding operation can be accomplished and smaller apparatus size and reduced production costs can be realized.

[0016]

In addition, in this case, since the aforementioned substrate rotation mechanisms 4 are constituted from a moving stand 6 that can advance and retreat in the direction of the rotary body 5, an advancing/retreating mechanism 7 that actuates advance and retreat of the moving stand 6, and a drive mechanism 9 that includes a drive belt that can be contacted and retracted from the rotary body 5 by the advancing/retreating

of the moving stand 6, by advancing and retreating the moving stand 6 with the advancing/retreating mechanism 7, and causing the drive belt 8 to contact with and separate from the rotary body 5, the rotary shaft 2 can be caused to rotate and stop, allowing the configuration to be commensurately simplified, and in this case, because the aforementioned drive belt 8 comprises an endless belt, the drive belt 8 is disposed threaded around a drive pulley 17 and a pair of guide pulleys 20, 27, one of the guide pulleys 27 is disposed so as to be able to move in the vicinity of the other guide pulley 20, and a spring member 25 is disposed that moves the one guide pulley 27 in the direction away from the other guide pulley 20, as shown in Figures 2 and 3, so that the drive pulley 8 is caused to contact the rotary body 5 curving along the circumferal surface thereof by advancing the moving stand 6, the rotary body 5 can be reliably contacted and rotated by the drive belt 8, and because the drive belt 8 is formed from a toothed belt in this case, the slipping of the rotary body 5 can be prevented and even more reliable rotating can be accomplished, so that excellent bonding work can be accomplished by commensurately increasing the rotational precision of the holding member 1.

[0017]

Furthermore, the present invention is not limited to the example embodiments described above, and the holding member 1 and substrate rotation mechanism 4 can be suitably modified and designed in other configurations, and substrate rotation mechanisms 4 are not limited to being in the adhesive application position and substrate rotation position, but may be disposed at any necessary position.

[0018]

Effect of the invention

The present invention is configured with a rotary body disposed on each rotary shaft, and a substrate rotation mechanism, which rotates the rotary body, at positions outside the rotary table at an adhesive application position and substrate rotation position in the invention disclosed in Claim 1, as described above, increases in inertial moment of the rotary table can be suppressed since the substrate rotation mechanisms that rotate the rotary shafts are not disposed on the rotary table, and the indexed positioning precision can be commensurately increased, allowing for the performance of a good bonding operation, and for the apparatus to be made smaller and its production costs to be reduced.

[0019]

In addition, since the aforementioned substrate rotation mechanism in the invention disclosed in Claim 2 is configured from a moving stand that enables advancing/retreating toward the aforementioned rotary body, an advancing/retreating mechanism that actuates advancing/retreating of the moving stand, and a drive mechanism that comprises a drive belt that enables contact and separation to and from said rotary body by the advancing/retreating operation of moving stand, the rotary shaft can be caused to rotate and stop, by contacting the drive belt with and retracting it from the rotary body by advancing/retreating the moving stand with the advancing/retreating mechanism, allowing the configuration can be commensurately simplified, and because, in the invention disclosed in Claim 3, the drive belt comprises an endless belt, the drive belt is disposed threaded around a drive pulley and a pair of guide pulleys, one of the guide pulleys being disposed so as to be movable within the vicinity of the other guide pulley, and a spring member is disposed that moves the one guide pulley in the direction away from the other guide pulley so that the drive pulley 8 is caused to contact the rotary body, curving along the circumferal surface

thereof by advancing the moving stand 6, the rotary body can be reliably contacted and rotated by the drive belt, and because the drive belt is formed from a toothed belt in the invention disclosed in Claim 4, the slipping of the rotary body can be prevented and even more reliable rotating by the drive belt can be accomplished, whereby the rotational precision of the holding member can be commensurately increased and excellent bonding work can be performed.

[0020]

The anticipated goals above can be fully achieved.

Brief description of the figures

Figure 1 is a partial side elevation drawing of an example embodiment of the present invention.

Figure 2 is a partial plan view drawing of an example embodiment of the present invention.

Figure 3 is a partial plan view drawing of an example embodiment of the present invention.

Figure 4 is a partial front view drawing of an example embodiment of the present invention.

Figure 5 is a partial cross-sectional drawing of an example embodiment of the present invention.

Figure 6 is an overall explanatory plan view drawing of an example embodiment of the present invention.

Figure 7 is an explanatory oblique view drawing of the bonding step.

Figure 8 is an explanatory oblique view drawing of the bonding step.

Figure 9 is an explanatory oblique view drawing of the bonding step.

Figure 10 is an explanatory side elevation drawing of the bonding step.

Explanation of symbols

W_1	Substrate
W_2	Substrate
S	Adhesive
a	Feed position
c	Adhesive application position
d	Stacking position
f	Substrate rotation position
T	Rotary table
1	Holding member
2	Rotary shaft
4	Substrate rotation mechanism
5	Rotary body
6	Moving stand
7	Advancing/retreating mechanism
8	Drive belt
9	Drive mechanism
17	Drive pulley
20	Guide pulley

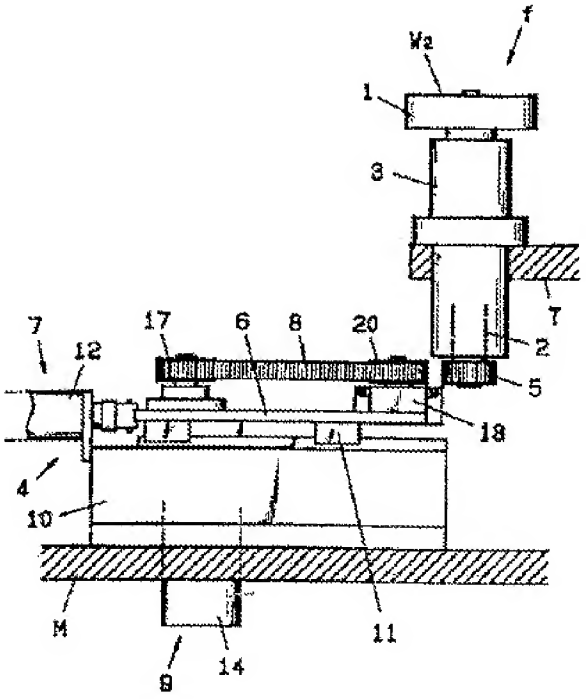

Figure 1

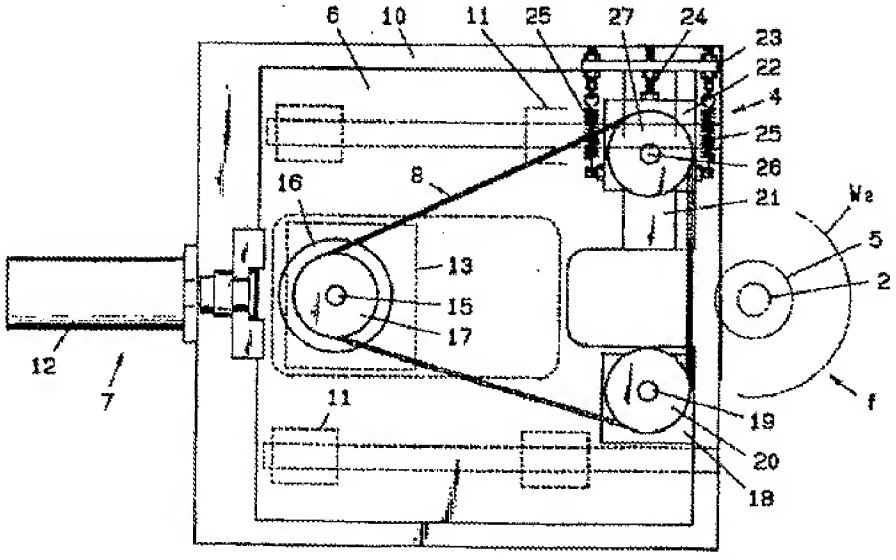

Figure 2

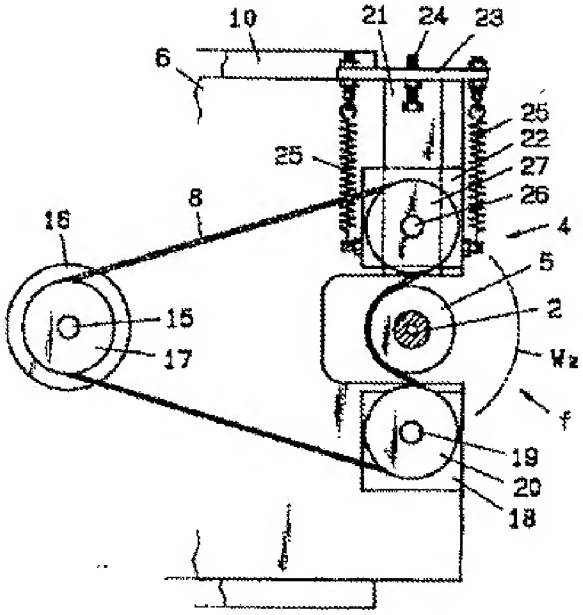

Figure 3

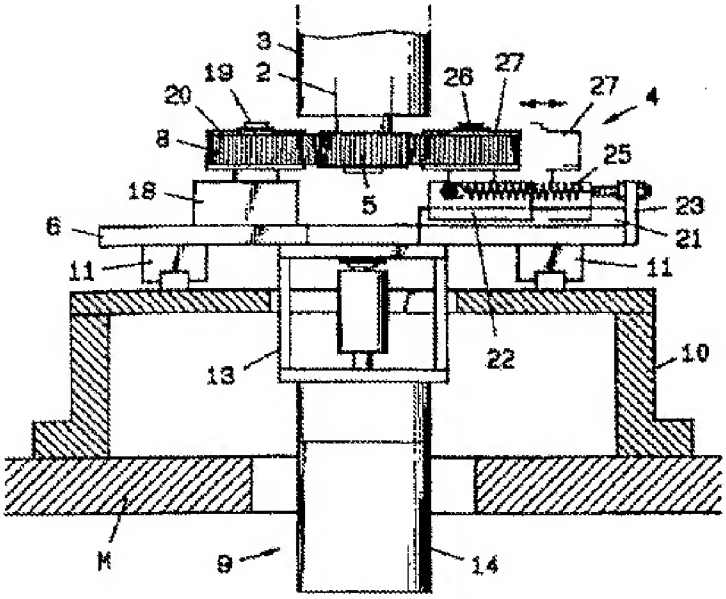

Figure 4

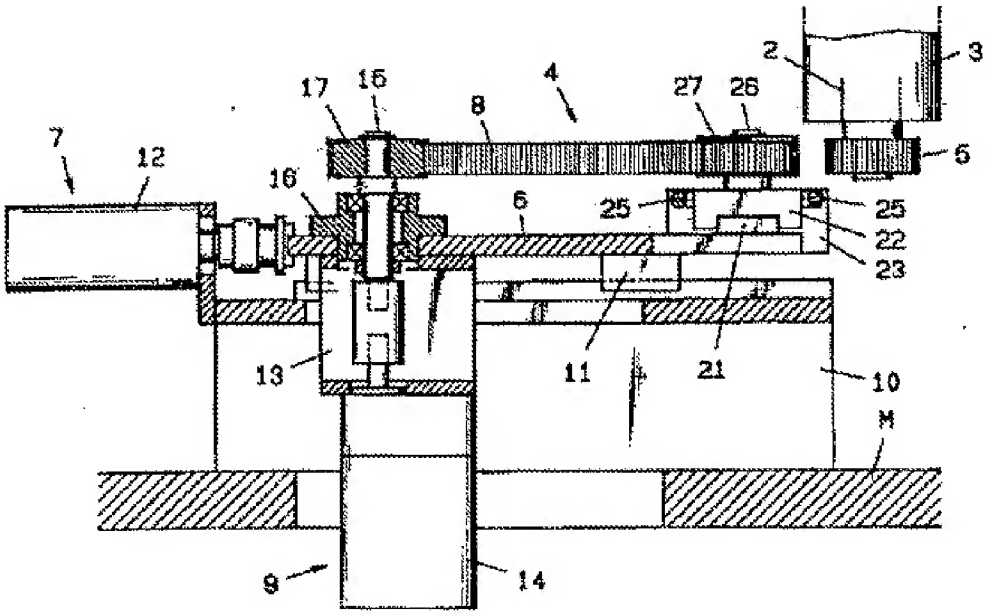

Figure 5

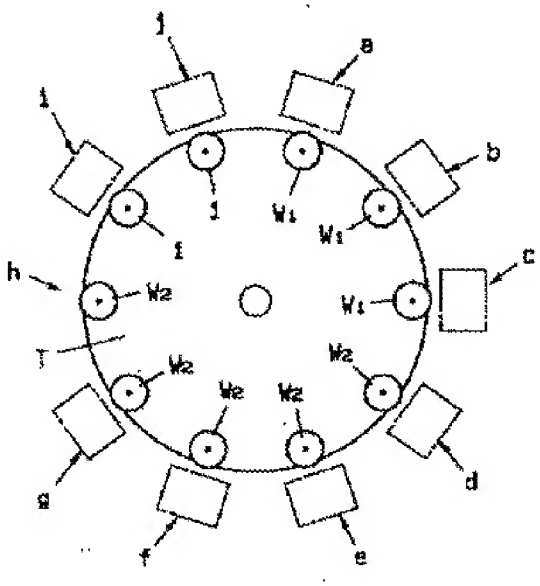

Figure 6

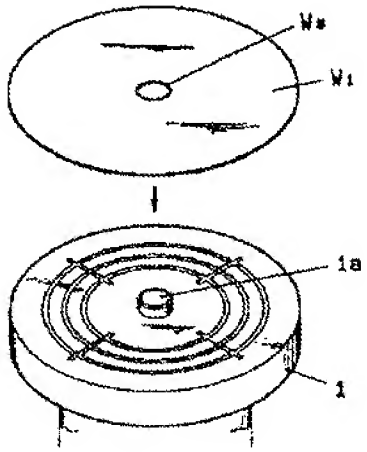

Figure 7

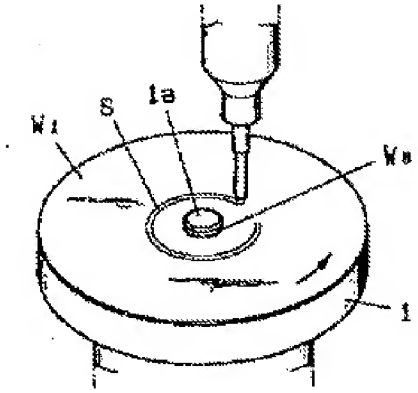

Figure 8

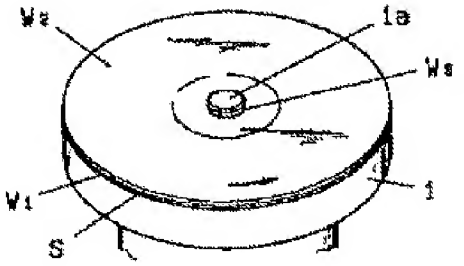

Figure 9

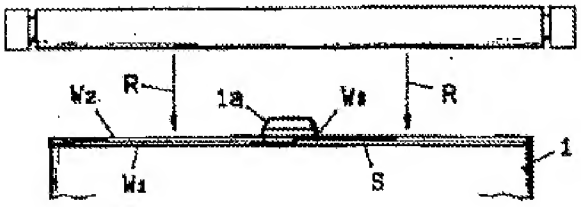

Figure 10